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Synthesis of Carbon Nanoparticles using *Borassus flabellifer*

C. Deepa[1*], E. Keerthana[2]

[*1,2]Department of Physics, Vellalar College for Women, Erode, Tamilnadu, India.

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Abstract

Carbon plays an important role in the development of Nanoscience and Nanotechnology because of its unique properties. Carbon is a cheap and abundant natural source, which used for the synthesis of multi-walled carbon nanotubes. Bio synthesis has an advantage over other synthesis, simple, eco-friendly low cost, wastes of Borassus flabellifer as a carbon source. The prepared sample is characterized by X-Ray diffraction(XRD), Fourier Transform Infrared Spectroscopy (FTIR), Scanning Electron Microscopy (SEM), Energy Dispersive X-ray spectroscopy(EDAX) were utilized to confirm the presence and quantity of prepared carbon nanomaterials. The carbon nanoparticles have many applications such as activated carbon used in treatment of cancer, medical sensors, etc.,

Keywords: *Carbon, nanoparticles, Borassus flabellifer, Bio synthesis, medical sensors*

1. INTRODUCTION

Nanotechnology as defined by size is naturally very broad, including fields of science as different as surface science, organic chemistry, molecular biology, semiconductor physics, micro fabrication, molecular engineering, etc [1]. Until 1985 it was generally believed that solid elemental carbon occurs in two different crystalline phases: diamond and graphite. Nanostructured carbon materials have attracted tremendous attention due to their unique structures and superior properties [2]. Carbon nanoparticles (CNPs) are of great interest for both fundamental studies and practical applications. CNPs have been widely used in supercapacitors, high performance electrode materials in batteries and excellent photo luminescent materials. The synthesis of carbon nanoparticles which emerges as safer and best alternative to conventional methods. The present work exhibits the synthesis of CNPs using *Borassus Flabellifer* by Bio-synthesis method. The carbon nanoparticles with *Borassus Flabellifer* being explored widely for use in cancer treatment [3].

2. MATERIALS & METHODS

Borassus flabellifer were collected in and around erode district, Tamil nadu, India.

*** C. Deepa**
email: chinnasamydeepa@gmail.com

2.1 Preparation of Carbon Nanoparticles

The collected seeds were cleaned with water. Further, the seeds were dried for15 minutes. After, the castor oil is applied on the inner and outer surface of the seeds. Then the seeds were burnt using a candle with a steel plate placed over the seeds to collect the particles coming out of the flame.

Fig. 1: Palmseeds

The process is continued until the black fumes get completely stacked at the vicinity of the steel plate. The black masses so obtained were grained to powder

using mortar. The dried powders were collected and characterized by X-Ray diffraction (XRD), Fourier Transform Infrared Spectroscopy (FTIR), Scanning Electron Microscopy (SEM), Energy Dispersive X-ray spectroscopy (EDAX).

Fig. 2: Carbon Nano powder

3. RESULT & DISCUSSION

3.1 FT-IR Analysis

FTIR spectra of synthesized CNPs from *Borassus Flabellifer* by biosynthesis method is shown in figure 3.1. FTIR analysis is employed to identify the functional group present in the material. The peaks observed at 3455.62 cm^{-1} and 2926.14cm^{-1} corresponds to O-H stretching. The peak observed at 1735.04cm^{-1} exibit the C-H bending. The peak observed at 1635.71-1561.44 cm^{-1} corresponds to C=C stretching. The peak observed at 1041.61cm^{-1} represents C-O stretching[11].

3.2 XRD Analysis

The crystallographic analysis was carried out by XRD, the XRD spectrum of prepared CNPs is shown in figure 3.2. The sharp peak shows that the prepared carbon powder is crystalline in nature. Crystallite size of the prepared carbon nanoparticles was calculated using Debye's Scherer formula [12].

$$D=(K\lambda/\beta\cos\theta) \qquad \text{.....(1)}$$

Where,

D = Crystallite size in nm,

K= Proportionality constant approximately equal to unity,

θ= angle of diffraction in degrees.

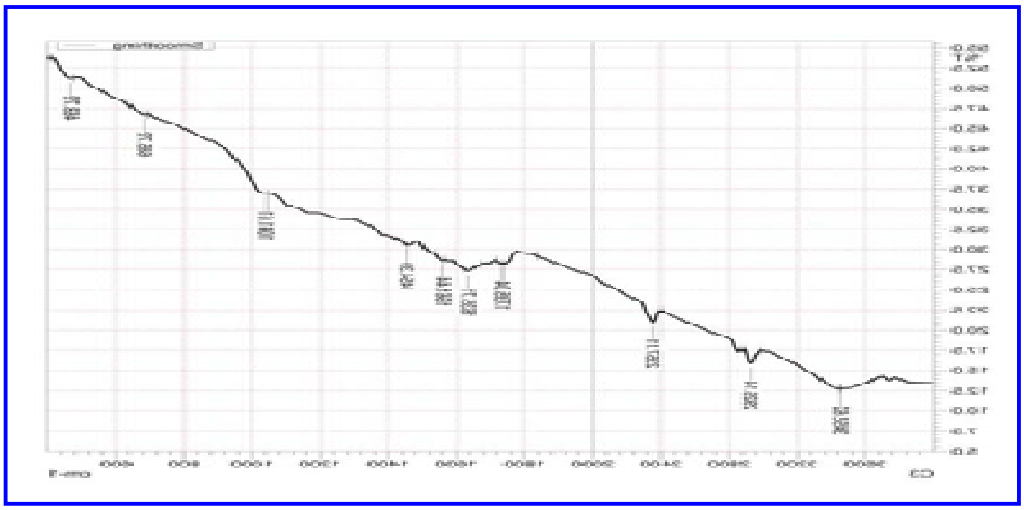

Figure 3.1: FTIR spectrum of CNPs

Table1 1. FTIR assignments of CNPs

S.No.	Wavelength in cm^{-1}	Assignments
1	3455.62	O-H stretching
2	2926.14	
3	1735.04	C-H bending
4	1635.71-1561.44	C=C stretching
5	1041.61	C-O stretching

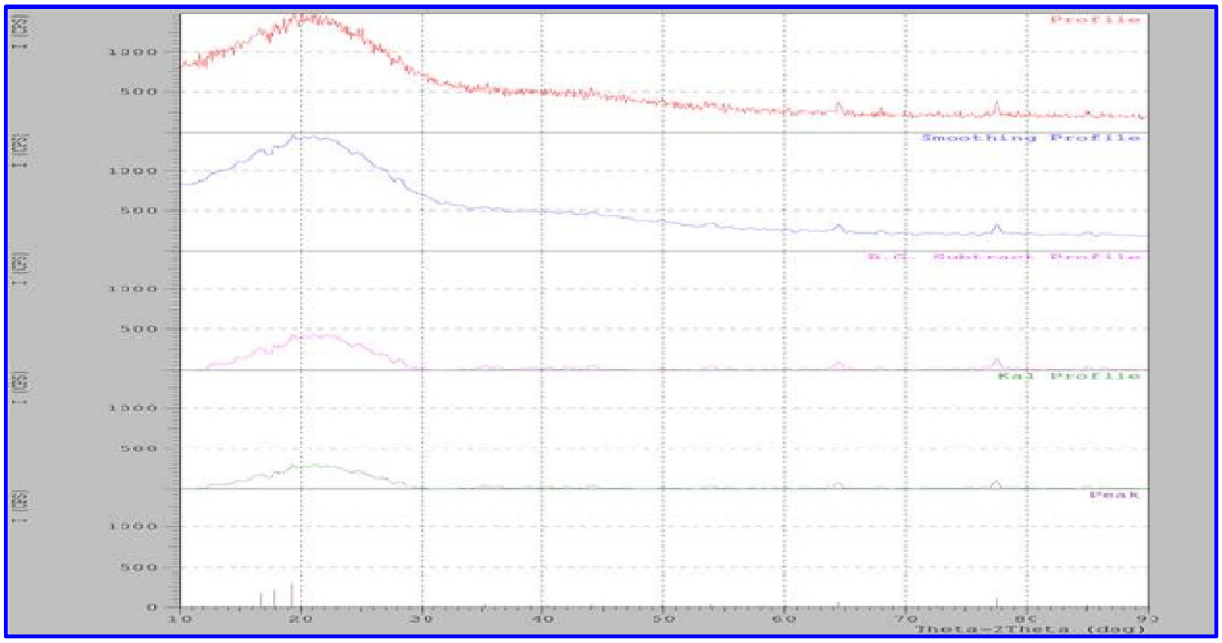

Fig. 3.2: XRD spectrum of CNPs

Table 2. Structural Analysis of the

2θ (deg)	FWHM (deg)	D (A^0)	Crystallite size (nm)	Average crystallite size(d) (nm)	Micro Strain ($\times10^{-3}$m)	Dislocation Density ($\times10^{15}$m)
19.3000	13.1556	4.5952	0.6039	1.2477	9.7640	0.00274
16.7000	4.2000	5.3043	1.8916		7.2061	0.02794

3.2.1 Micro Strain

The micro strain can be calculated from the following equation

$$E_{Strain}=\beta/4\tan\theta \quad \text{.....(2)}$$

Where, β = full with half maximum of the peak in radians, θ = diffracted angle of X-ray pattern in degrees. The structural Analysis of the prepared CNPs re listed in Table 2.

3.2.2 Dislocation Density

The dislocation density can be calculated using the following formula

$$\delta=1/D^2 \quad (3)$$

D = Crystallite size of the sample in nm

3.3 Scanning Electron Microscopy

The SEM images of the prepared CNPs using bio synthesis method for different resolution is sown in figure 3.3. The morphology of prepared sample of the synthesized CNPs at different resolution well disperse jelly crystalline structure morphology was observed using SEM analysis [13].

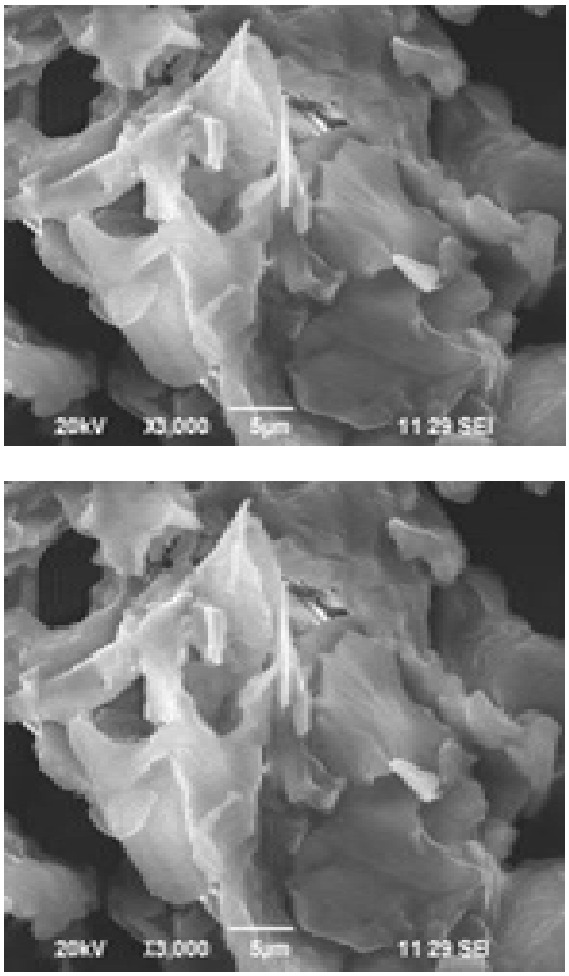

Fig. 3.3: SEM images of CNPs

3.4 Energy Dispersive X-Ray Spectroscopy

Figure 3.4 exhibits the elemental composition of CNPs. The spectra reveal the presence of C, O. EDAX analysis reveals that the synthesized sample is pure CNPs.

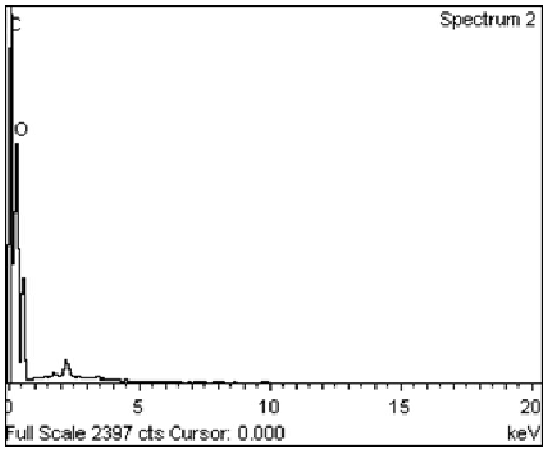

Fig 3.4: EDAX spectrum

4. CONCLUSION

Carbon Nano particles were successfully prepared by biosynthesis method using Borassus Flabellifer seeds and castor oil. The straight line and sharp peaks in XRD spectrum reveals that the synthesized carbon nanoparticles were crystalline in nature.The FTIR spectrum confirms the presence of C-O stretching, C=C stretching Respectively. The SEM image depicts the morphology of prepared CNPs, it reveals jelly crystalline structure and well dispersed in aqueous solution with uniform size. The EDAX analysis exhibit the elemental composition of CNPs. The spectrum reveals the presence of C, O. It is used to develop high-capacity lithium sulphur batteries.

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